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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/708,020	02/03/2004	Bangalore A. Nagaraj	122779	2019

30952 7590 02/05/2007
HARTMAN AND HARTMAN, P.C.
552 EAST 700 NORTH
VAIPARAISO, IN 46383

EXAMINER	
AUSTIN, AARON	
ART UNIT	**PAPER NUMBER**
1775	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	02/05/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/708,020	NAGARAJ ET AL.	
	Examiner	Art Unit	
	Aaron S. Austin	1775	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05 December 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-12 and 14-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-12 and 14-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 12/05/06 has been entered.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 11 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In particular, the second ceramic layer is claimed as having a maximum thickness of about 2000 micrometers in claim 11. This maximum value conflicts with the maximum thickness of the combined first and second ceramic layers of about 2000 micrometers set forth in claim 9. If the second layer is formed having the maximum thickness, the first layer can't be present or would be of a negligible thickness, neither of which is enabled by the disclosure. Therefore the claim is indefinite.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-12 and 14-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Darolia et al (US 6,887,595) in view of Wisander et al (US 4,377,371).

Darolia teaches a thermal barrier coating for a metal substrate comprising a first layer of zirconia stabilized with up to 10 wt% stabilizer, and a second layer of zirconia stabilized with 10-30 wt% stabilizer. The second layer is provided with a thickness greater than the first layer. A bond coating and an alumina layer are present between the substrate and the first and second coatings of zirconia. Regarding the phases of the zirconia layers, the amounts of stabilizers added to the zirconia layers overlaps with that of the instant claims. Specifically, the first layer is preferably stabilized with about 5-8 wt% stabilizer, and the second layer is 10-30 wt%. As these ranges clearly overlap with the instant claims, the stabilization is expected to be similar, resulting in similar phases.

Darolia does not specifically teach the presence of microcracks in the second zirconia layer.

Wisander et al teach a thermal barrier coating for a turbine engine component substrate, the coating comprising second zirconia layers. Vertical microcracks are generated in the coating by scanning a laser beam over the plasma-sprayed ceramic

surface (column 2, lines 11-12). These cracks provide resistance against formation and growth of catastrophic cracks during exposure to thermal shock as well as improved erosion resistance for the thermal barrier coating. It would have been obvious to one of ordinary skill in the at the time of the invention to provide the thermal barrier coating of Darolia with microcracks like those taught by Wisander et al., as it is clearly taught that the microcracks provide the benefit of improved resistance against thermal shock damage and improved erosion resistance during use.

Claims 1-12 and 14-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Darolia et al (US 6,887,595) in view of Taylor (US 5,073,433), and further in view of Taylor (US 5,520,516).

Darolia teaches a thermal barrier coating for a metal substrate comprising a first layer of zirconia stabilized with up to 10 wt% stabilizer, and a second layer of zirconia stabilized with 10-30 wt% stabilizer. The second layer is provided with a thickness greater than the first layer. A bond coating and an alumina layer are present between the substrate and the first and second coatings of zirconia. Regarding the phases of the zirconia layers, the amounts of stabilizers added to the zirconia layers overlaps with that of the instant claims. Specifically, the first layer is preferably stabilized with about 5-8 wt% stabilizer, and the second layer is 10-30 wt%. As these ranges clearly overlap with the instant claims, the stabilization is expected to be similar, resulting in similar phases.

Darolia does not specifically teach the presence of microcracks in the second zirconia layer.

Taylor '433 teaches a thermal barrier coating for a turbine engine component substrate, the coating comprising a zirconia layer. Vertical microcracks are generated in an amount of 20 to 200 per inch in the coating (claim 1) in a process taught by applicant's specification as being a preferred process for the present invention (see paragraph [0019]). These cracks provide resistance against thermal fatigue (abstract). It would have been obvious to one of ordinary skill in the at the time of the invention to provide the thermal barrier coating of Darolia with microcracks like those taught by Taylor '433, as it is clearly taught that the microcracks provide the benefit of improved resistance to thermal fatigue.

Neither Darolia not Taylor '433 teach microcracks in a fully stabilized zirconia layer.

However, one of ordinary skill in the art at the time of the claimed invention would recognize the benefits provided by the microcracks are not dependent upon whether the zirconia is partially or fully stabilized. As such, the benefits of microcracks in zirconia as taught by Taylor '433 are not limited to partially stabilized zirconia.

Further, Taylor '516 teaches formation of macrocracks in either a partially or fully stabilized zirconia layer (column 3, line 32). Therefore, as Taylor '516 clearly teaches formation of beneficial cracks in zirconia coatings for turbine engine components may be formed in either partially or fully stabilized zirconia, it would have been obvious to one of ordinary skill in the art at the time of the claimed invention to form the cracks taught by Taylor '433 in the zirconia coating taught by Darolia. Thus the claimed invention as a whole is *prima facie* obvious over the combined teachings of the prior art.

Claims 1-12 and 14-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al (US 6,764,779) in view of Wisander et al (US 4,377,371).

Liu teaches a thermal barrier coating for a turbine engine component substrate comprising alternating layers of zirconia. The layers have different amounts of stabilizer, wherein the first layer have about 6-8 wt% yttria, and the second layers have about 18-22 wt% yttria. Regarding the phases of the zirconia layers, the amounts of stabilizers added to the zirconia layers overlaps with that of the instant claims. Specifically, the first layer is preferably stabilized with about 6-8 wt% stabilizer, and the second layer is 18-22 wt%. As these ranges clearly overlap with the instant claims, the stabilization is expected to be similar, resulting in similar phases.

Liu does not specifically teach the presence of microcracks in the second zirconia layer, and does not teach the second layer or layers being thicker than the first layer or layers.

Wisander et al teach a thermal barrier coating for a turbine engine component substrate, the coating comprising second zirconia layers. Vertical microcracks are generated in the coating by scanning a laser beam over the plasma-sprayed ceramic surface (column 2, lines 11-12). These cracks provide resistance against formation and growth of catastrophic cracks during exposure to thermal shock as well as improved erosion resistance for the thermal barrier coating. It would have been obvious to one of ordinary skill in the art at the time of the invention to provide the thermal barrier coating of Liu with microcracks like those taught by Wisander et al, as it is clearly taught that

these microcracks provide the benefit of improved resistance against thermal shock damage and improved erosion resistance during use. Both Liu and Wisander et al teach similar methods of application of the zirconia coatings (APS), and have similar applications (thermal barrier coatings for turbine engine components).

Regarding the thickness of the layers, Liu teaches the application of multiple layers (up to 100 total) with each layer having a thickness of 1-50 microns. Liu does not appear to teach that each layer must be provided with the same thickness. Absent a showing of unexpected results, it would have been obvious to one of ordinary skill in the art to provide the layers of Liu with a thickness sufficient to perform the desired function of corrosion and oxidation resistance. Variation of the thickness does not appear to provide a contribution over the art of record.

Claims 1-12 and 14-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al (US 6,764,779) in view of Taylor (US 5,073,433), and further in view of Taylor (US 5,520,516).

Liu teaches a thermal barrier coating for a turbine engine component substrate comprising alternating layers of zirconia. The layers have different amounts of stabilizer, wherein the first layer have about 6-8 wt% yttria, and the second layers have about 18-22 wt% yttria. Regarding the phases of the zirconia layers, the amounts of stabilizers added to the zirconia layers overlaps with that of the instant claims. Specifically, the first layer is preferably stabilized with about 6-8 wt% stabilizer, and the

second layer is 18-22 wt%. As these ranges clearly overlap with the instant claims, the stabilization is expected to be similar, resulting in similar phases.

Liu does not specifically teach the presence of microcracks in the second zirconia layer, and does not teach the second layer or layers being thicker than the first layer or layers.

Taylor '433 teaches a thermal barrier coating for a turbine engine component substrate, the coating comprising a zirconia layer. Vertical microcracks are generated in an amount of 20 to 200 per inch in the coating (claim 1) in a process taught by applicant's specification as being a preferred process for the present invention (see paragraph [0019]). These cracks provide resistance against thermal fatigue (abstract). It would have been obvious to one of ordinary skill in the at the time of the invention to provide the thermal barrier coating of Lui with microcracks like those taught by Taylor '433, as it is clearly taught that the microcracks provide the benefit of improved resistance to thermal fatigue.

Regarding the thickness of the layers, Liu teaches the application of multiple layers (up to 100 total) with each layer having a thickness of 1-50 microns. Liu does not appear to teach that each layer must be provided with the same thickness. Absent a showing of unexpected results, it would have been obvious to one of ordinary skill in the art to provide the layers of Liu with a thickness sufficient to perform the desired function of corrosion and oxidation resistance. Variation of the thickness does not appear to provide a contribution over the art of record.

Neither Liu not Taylor '433 teach microcracks in a fully stabilized zirconia layer.

However, one of ordinary skill in the art at the time of the claimed invention would recognize the benefits provided by the microcracks are not dependent upon whether the zirconia is partially or fully stabilized. As such, the benefits of microcracks in zirconia as taught by Taylor '433 are not limited to partially stabilized zirconia.

Further, Taylor '516 teaches formation of macrocracks in either a partially or fully stabilized zirconia layer (column 3, line 32). Therefore, as Taylor '516 clearly teaches formation of beneficial cracks in zirconia coatings for turbine engine components may be formed in either partially or fully stabilized zirconia, it would have been obvious to one of ordinary skill in the art at the time of the claimed invention to form the cracks taught by Taylor '433 in the zirconia coating taught by Liu. Thus the claimed invention as a whole is *prima facie* obvious over the combined teachings of the prior art.

Response to Arguments

Applicant's arguments, see the Remarks, filed 12/05/06, with respect to the rejections under 35 USC 112 relating to the term "an amount sufficient to" have been fully considered and are persuasive in light of the present amendment. The rejections on this basis have been withdrawn.

Applicant's arguments filed 12/05/06 with respect to the outstanding prior art rejections have been fully considered but they are not persuasive.

Applicant first argues Lui teaches away from the claimed invention in that the partially stabilized zirconia layer is the outermost layer of the TBC system rather than

the fully stabilized layer as claimed. However, Lui teaches alternating layers wherein partially stabilized zirconia is found under the fully stabilized zirconia, thereby meeting the claimed limitations. The term "comprising" in the present claims does not prevent the presence of additional layers; therefore Lui does not teach away from the claimed invention.

Applicant next argues Wisander produces microcracks using a laser, thereby resulting in a physically fused and dense structure contrary to the form of the present amendments. However, Wisander was used in the rejection to show the obviousness of the presence of microcracks in preventing thermal shock and improving erosion resistance. The reference was not used to identify as obvious the method of production of the microcracks. Further, the new claim language "characterized by irregular flattened grains and a degree of inhomogeneity and porosity" is a characteristic imparted by the thermal spraying, such as plasma spraying, of the coating as set forth in the present application (paragraph [0014]). Wisander teaches microcracks formed in a plasma sprayed surface (column 2, line 55) and thus a layer having the claimed characteristics. The fused layer only forms where the laser is used to create microcracks (column 2, lines 56-57) and thus will not result in fusing of the entire layer. Therefore the structure of Wisander does not teach away from that of the present claims, particularly as the rejection relies on Wisander to teach the obviousness of the presence of microcracks.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Aaron S. Austin whose telephone number is (571) 272-8935. The examiner can normally be reached on Monday-Friday: 7:30 AM to 4:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jennifer McNeil can be reached on (571) 272-1540. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

ASA

JOHN J. ZIMMERMAN
PRIMARY EXAMINER